

Occurrence of the Brook Silverside, *Labidesthes sicculus*  
(Atheriniformes: Atherinidae), in North Carolina

Mary L. Moser  
*Center for Marine Science Research*  
7205 Wrightsville Avenue  
Wilmington, NC 28403

Fred C. Rohde  
*North Carolina Division of Marine Fisheries*  
127 Cardinal Drive Extension  
Wilmington, NC 28405-3845

Rudolf G. Arndt  
*Faculty of Natural Sciences and Mathematics*  
*The Richard Stockton College of New Jersey*  
Pomona, NJ 08240

and

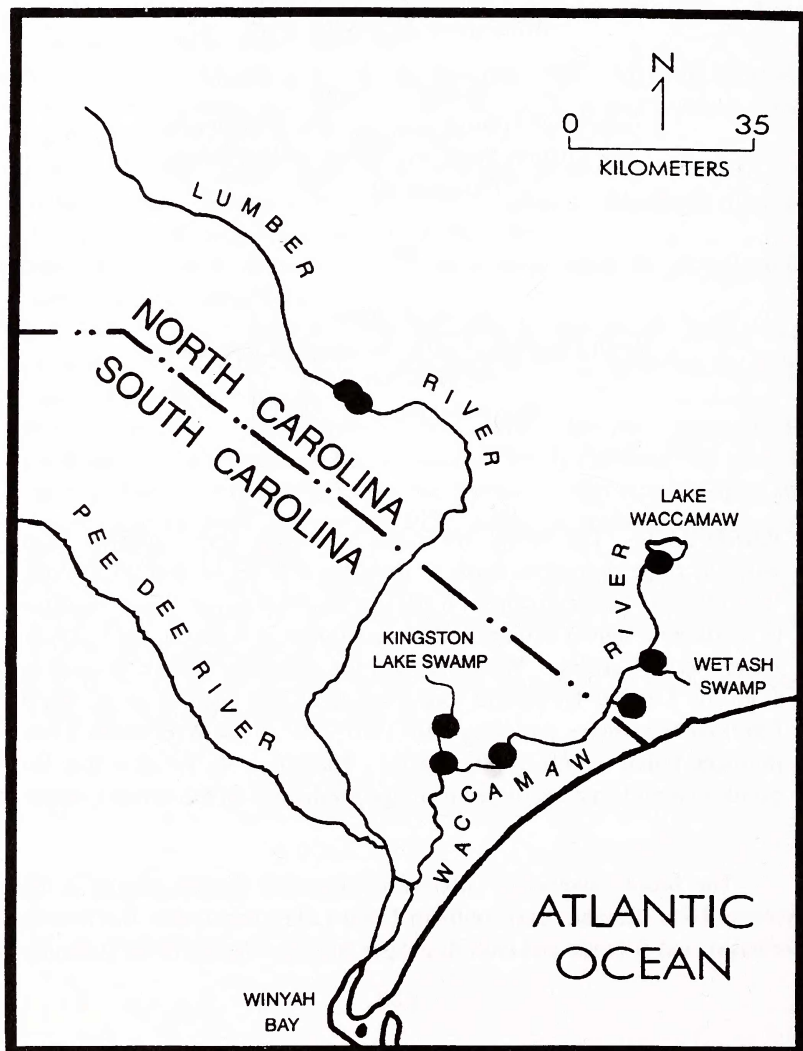
Keith W. Ashley  
*North Carolina Wildlife Resources Commission*  
102 Hillcrest Drive  
Elizabethtown, NC 28337

ABSTRACT- The brook silverside has never been reported from Atlantic slope drainages north of the Santee River in South Carolina. We collected 42 specimens at 6 sites in the Waccamaw River drainage in North and South Carolina and 26 specimens at 5 sites in the Lynches River, South Carolina. We also report the collection of five specimens from the Lumber River and four from the Cape Fear River in North Carolina. Extensive sampling from 1961-1992 in the Waccamaw River drainage failed to collect this species. Therefore, we propose that the brook silverside has expanded its range northward on the Atlantic slope.

The brook silverside, *Labidesthes sicculus* (Cope), occurs in the St. Lawrence River drainage and southern Great Lakes tributaries, the Mississippi River basin, and Atlantic and Gulf drainages from the Santee River in South Car-

olina to the Sabine River in Texas (Etnier and Starnes 1994). Reported occurrences closest to the state of North Carolina are from eastern Tennessee, in the Little Tennessee River drainage (Etnier and Starnes 1994), and from eastern South Carolina, in the Santee River drainage (Rohde et al. 1994). Our sampling indicates that the brook silverside in the southeastern United States has expanded its range northward.

Fig. 1. Distribution of the brook silverside, *Labidesthes sicculus*, in southeastern North Carolina and adjacent South Carolina.



### SURVEY AREA

The Waccamaw River originates at Lake Waccamaw in Columbus County, North Carolina, and flows approximately 63 km south-southwest to the North Carolina/South Carolina border (Fig. 1). The river has a total length of approximately 225 km and joins the Pee Dee River at Winyah Bay, South Carolina (Shute et al. 1981). In North Carolina the Waccamaw River drains 3,255 km<sup>2</sup> of primarily forested land and has a relatively low ratio of base flow to runoff (Bales and Pope 1996). Tributary streams in this system are generally highly colored, low pH, low flow to stagnant, blackwater swamps. Many of these streams exhibit large seasonal changes in depth and flow, with concomitant changes in discharge. Recent studies of streamflow characteristics in this drainage indicate that flow variability has increased the past decade (Bales and Pope 1996).

### METHODS AND MATERIALS

We sampled at 39 sites in the Waccamaw River drainage from May 1994-mid-November 1996. Standardized sampling was conducted at each site using a backpack electroshocker, seine, and/or rotenone. For sites in North Carolina ( $n = 18$ ), we used coated nylon nets (50 m, 1.3 cm-mesh) to block off a 33 m or 66 m reach. Three passes were made through the blocked off area using either a backpack electroshocker or a 3 m x 1.2 m, 3.2-mm mesh seine. For rotenone samples, fish were dipnetted for up to two hours following introduction of rotenone at 1 ppm. Rotenone was then neutralized using a 1 ppm potassium permanganate solution. South Carolina collections ( $n = 21$ ) were made with a 3 m x 1.2 m, 3.2-mm mesh seine, except for one backpack electroshocker collection. Fishes taken, and data on habitat (stream depth, width, and substrate type; current speed; air and water temperatures; pH; dissolved oxygen concentration) were recorded at each site.

All fishes were preserved in 10% formalin upon capture for subsequent examination. Brook silversides were measured to the nearest mm standard length (SL) and deposited at the North Carolina State Museum of Natural Sciences in Raleigh.

### RESULTS AND DISCUSSION

In North Carolina we collected 36 brook silversides. We took 18 specimens in the Waccamaw River 50 m below the Lake Waccamaw dam, Columbus County, on the 14th (5 specimens by electroshocker) and 18th (13 by rotenone) of September 1995 (Fig. 1). Size range of these fish was 29-48 mm SL, and 2-3 size classes were represented. Current velocity at this site was 0.17 m/sec with a pH of 6.4 and dissolved oxygen of 7.2 mg/L. We also took two specimens (34, 40 mm SL) by electroshocker in Wet Ash Swamp, a Waccamaw River tributary, at a point 50 m below the State Route 1300 bridge in Brunswick County, on 14 September 1995 (Fig. 1). Current there was 0 m/sec, pH 5.8, and dissolved oxy-

gen concentration was 8.8 mg/L. A second Waccamaw River tributary, Shingle-tree Swamp, yielded three juveniles on 18 November 1996, and three juveniles and one adult on 11 April 1997. In addition, survey sampling with a boat electroshocker produced five specimens in the Lumber River at the NC Route 711 bridge in Robeson County on 8 May 1995 (Fig. 1). Size range was 57-65 mm SL. Four additional fish (48, 53, 60, and 78 mm TL) were collected with the boat electroshocker from the Cape Fear River at rkm 76 on 24 January 1997.

In South Carolina we collected 15 specimens of the brook silverside from the Waccamaw River drainage and 26 specimens from the Lynches River with a seine. Four specimens were taken on 27 May 1994 in the Waccamaw River at Conway in Horry County. We took eight more fish from Kingston Lake Swamp, a tributary of the Waccamaw River, near Conway, approximately 54 rkm downstream of the North Carolina border, on 10-11 May 1994. Three specimens were also collected in Stanley Creek, a tributary stream approximately 11.8 km northeast of Conway on 18 March 1996. From 13-17 May 1996, we sampled 10 sites in the Lynches River, a tributary of the Pee Dee River. Brook silversides ( $n = 26$ ) were collected at five of these sites from the Route 403 bridge, Florence/Lee counties north to the Route 15 bridge, Kershaw/Darlington counties, a distance of approximately 50 rkm. These localities fill in a gap between the previously known South Carolina records in the Santee River drainage and the new North Carolina records (Rohde et al. 1994).

Is the distribution of the brook silverside expanding, or has the species been overlooked in North Carolina? The sites in the North Carolina portion of the Waccamaw River, as well as other sites in this drainage, have been sampled frequently by E. Menhinick, J. and P. Shute, Wildlife Resources Commission biologists, and by F. Rohde. Twenty-nine collections were made by these biologists at the Waccamaw River site from 1979-1992, and 5 collections in Wet Ash Swamp during 1961-1989. Since 1960, numerous other sites have been sampled on multiple occasions with rotenone (39 sites), seines (38), and electroshockers (10). This intensive sampling over time argues for an increase in brook silverside distribution. In addition, the fact that this species is fragile suggests that the observed range expansion did not result from "bait-bucket" introductions. We propose that the brook silverside has expanded its range northward and may be longer lived than previously thought.

**ACKNOWLEDGMENTS-** For assistance in field work we thank those students too numerous to mention here individually from The Richard Stockton College of New Jersey and the University of North Carolina at Wilmington, and Tom Rachels of the N.C. Wildlife Resources Commission. A. Braswell, North Carolina State Museum of Natural Sciences, answered questions on specimens in his care. The Graphics Production Department of Stockton College, and L.M. Neveu, helped to prepare the figures. This research was supported in part by a

grant from the North Carolina Division of Water Resources by the Cape Fear River Program, and by travel funds and vehicles provided by Stockton College. These surveys were conducted under North Carolina Wildlife Resources Scientific Collecting Permit Number 39.

#### LITERATURE CITED

- Bales, J. D., and B. F. Pope. 1996. Streamflow characteristics of the Waccamaw River at Freeland, North Carolina, 1940-94. Water Resources Investigations Report 96-4093, U.S. Geological Survey, Raleigh, North Carolina.
- Etnier, D.A., and W.C. Starnes. 1994. The fishes of Tennessee. University of Tennessee Press, Knoxville.
- Rohde, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. Freshwater fishes of the Carolinas, Virginia, Maryland, and Delaware. The University of North Carolina Press, Chapel Hill.
- Shute, J.R., P.W. Shute, D.G. Lindquist. 1981. Fishes of the Waccamaw River drainage. *Brimleyana* 6:1-24.

*Received 10 October 1996*

*Accepted 6 November 1996*